CENTRAL INTELLIGENCE AGENCY

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INFORMATION REPORT

25X1A

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COUNTRY USSR (Kalinin Oblast)

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SUBJECT Technical Information on the EF-150, Helicopters, Radar Reflectors, and Possible Guided Missile Parts Produced at Zavod No. 1 at Podberezhe.

NO. OF PAGES 6

25X1C [redacted]

NO. OF ENCLS. 9
(LISTED BELOW)

SUPPLEMENT TO REPORT NO. 25X1X

[redacted]

DETAILS OF THE EF-150

25X1 [redacted]

Landing Gear

General:

1. The landing gear installation had not been completed [redacted] 25X1
25X1 [redacted] However, I saw some of the components and once saw some engineers and mechanics checking the fit of the front main gear in its mounting brackets. I know that the larger or forward actuating cylinder was made of steel and had a bore of approximately 180 mm and a stroke of about 1000 to 1100 mm. It did not contain a mechanical lock. Therefore, I think that the front gear swung down and forward and was locked hydraulically. Mechanical locks in cylinders, when used, were of the type shown on Enclosure (A). The bomb bay door actuating cylinder had such a lock. The

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other cylinder was made of aluminum and had a bore of about 100 to 110 mm and approximately the same stroke as the front cylinder. For these reasons, I think that the aft gear swung down and aft. The strut probably swung past the pivot center, thus mechanically aiding the hydraulic downlock. I am not certain, but believe that it had an internal lock. The locations of the shock cylinders in their respective struts are not known/ [redacted]

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2. I did not hear of any plans for partial retraction to change the airplane's attitude. I presume that if the rear actuating cylinder was strong enough to take the load, the aft gear could be partially retracted hydraulically. Both cylinders were solidly anchored to aircraft structure; hence, there was no mechanical means of partial retraction. The front gear was steerable, but I know no further details except that there was a relief valve (or valves) in the piston of the steering cylinder to keep from overloading the structure if one of the front tires should hit an obstacle. I am sure that the front main gear had dual wheels. I once saw a single-tired rear wheel sitting in place under the airplane. It was larger in diameter than the front wheels. I do not know whether this was to be used in the final installation or not. Leakage tests had been conducted on the actuating cylinders, but no high pressure or life cycling tests. I assume that functional tests on the complete system were to be made on the airplane.

Shock Struts

3. In order to make the strut more compact and to provide a variable spring rate, the main gear shock strut was made as shown on the sketch [redacted] [Enclosure (C)]. The one sketched is the rear strut, [redacted] familiar with its dimensions and design. (The front strut was of the same design but about 20% larger.) The main problem with this design was in filling and servicing the strut with air. The various chambers had to be filled one at a time beginning with the inner one and, once assembled, the pressure could not even be checked. The same filling procedure was used for each of the chambers. With the cylinder held in a special fixture and the retaining nut backed off about 75 mm, the inner cylinder was pressurized to 230 atmospheres. The nut was then tightened down and locked with a set screw. The inner cylinder assembly was then installed in the next cylinder, and it was filled to 185 atmospheres. The outer chamber was filled in a like manner to 130 atmospheres. Instead of a nut, the segmented retainer ring [shown on Enclosure (C)] was used in the outer cylinder. To get the desired spring rate, the volume of the individual chambers was adjusted by partially filling each one with oil. The piston was made of dural and the rest of the assembly of steel. Four different seal installations were tested. [All were based on a chevron-type seal as shown on the sketch. Other types of seals were discussed, including "O" rings. Source thought that the material that the Soviets supplied would be too hard to make a satisfactory O-ring.] Two main problems were encountered with the seals tested: (1) wear of the seals due to the cylinders' not being honed, and (2) extrusion of the seals due to the high pressures used. On the sketch [Enclosure (C)] #1 was the best seal installation, and the others shown decreased in effectiveness as the number increased. The backing rings shown were all designed to prevent seal extrusion. The brass ring of installation #3 showed signs of excessive wear, particularly at the corners, and would not hold its shape after being subjected to operating pressures. The material in the "fiber" ring (installation #1 and #2) looked like the hard impregnated cardboard gaskets used with automobile carburetor jets. The tests on #2 indicated the seal was moving around too much. To prevent this, the aluminum ring of installation #1 was installed.

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4. The Hydraulics Laboratory conducted the following tests:

(1) Each individual cylinder was proof tested before assembly. The cylinder was held in a special fixture and pressurized with water. The pressure used to test each individual cylinder is not known to me, but at least one cylinder was subjected to a maximum pressure of 400 atmospheres.

(2) After filling and assembling the strut it was checked for leakage by immersion in kerosene. /See Enclosure (D)./ There was no definite length of time for the leakage test, but it was usually left overnight and checked in the morning. Even slight leakage was unsatisfactory.

(3) The strut was then put in a tensile testing machine and load deflection curves made by means of a pressure recorder.

(4) The tensile test machine was also used to subject the strut to a life test. The strut was required to withstand 200 cycles, but due to failures the highest number ever attained was 150. After every 10 cycles the test specimen was removed, turned end for end, and reinstalled in the holding fixture. After every 25 cycles a load-deflection diagram was made. During the life tests the strut was cooled with water at approximately 15° C.

Approximately 10 series of tests were run, six to check various seal designs, and the remainder to try out other new parts. (Producing straight and concentric cylinders presented a serious machining problem.) Simulated drop tests were also run in a drop hammer in the Static Test Laboratory. The number of cycles and results of these tests are unknown to me. Honing was originally omitted at Soviet request, since they were always interested in shortcuts, and probably hoped that the Germans could make a satisfactory cylinder
25X1X without honing. [redacted] it had been decided to hone the cylinders. It was necessary for stone holders for the honing machine to be fabricated, but this had not been done by the time I left the
25X1 plant [redacted] (I also think that the Soviets supplied low quality seal material to see what the Germans could do with it.)

5. A new strut design was also planned to permit filling and checking of air pressure after the unit was assembled and installed. I assume this would necessitate using only two compartments to avoid a complicated means of getting air into the inner chamber. As of
25X1X [redacted] taxi tests were not authorized because of the unsatisfactory struts.

Outrigger Gear Strut:

25X1X 6. The unit shown [redacted] /Enclosure (E)/ was a combination shock and retraction cylinder. I do not know the mechanical connections necessary to accomplish retraction. Furthermore, I have not seen the details of the outer or retraction cylinder; hence, it is shown by dotted lines. The inner or shock part of the strut was similar in principle to that for the main gear except that it had two instead of three chambers. I know that the two chambers had different pressures but do not remember the figures for either. I remember that 2300 cc of oil were put in Chamber "B" to adjust its volume in order to get the desired spring rate. As in the case of the main gear strut, the air pressure could not be checked or serviced after the strut was assembled. The piston separating Chambers "A" and "B" floated on the guide that was part of the end plug of the inner cylinder. Its compressed position is shown on the sketch by dotted lines.

The bronze piston ring and the long piston rod guide on the wheel end of the unit were designed to give rigidity to the strut assembly. /The retraction part of the unit may have had a mechanical lock similar to that shown on Enclosure (A), [redacted] It could have been located only on the upper end; and, if there were such a lock, the plug in the end of the shock cylinder would not have been dished out as shown on Enclosure (E)./ The same types of leakage and load-deflection tests were made on the outrigger strut as were run on the main struts. [redacted] life tests had not been run. Since the outrigger strut cylinders were also not honed, the results of the main gear tests should apply equally well to the outrigger struts. 25X1A 25X1A

Flight Control System

7. I was not directly connected with the work on the Servo-mechanism flight control system, and hence my knowledge is based on hearsay and occasional observations of the laboratory test set-up. Although the schematic /Enclosure (F)/ is for the aileron system, the other axes functioned in the same manner. I have no detailed information concerning the inner workings of the power unit (Hydraulishes-Aggregat) but believe it operated on the same principle as the Junkers FA-15 remote gun turret control system. I am reasonably sure that there was no automatic pilot system designed for the EF-150. I do not think that there was any simulated "feel" built into the power system. It will be noted that the aileron is shown in two sections /on Enclosure (F)/. I base this division not on observation of the aileron itself, but on the known number of screw jacks (six) built for the airplane. Power was transmitted from the hydraulic unit to the surfaces by means of dural torque tubes, bevel gears, and screw jacks. The dural tubes were approximately 50 mm in diameter. I do not know what means, if any, were used to overcome backlash in the gears. A double nut (shown on the sketch) was designed to eliminate backlash in the screw jack. The nuts were locked together by small set screws. I believe that the shaft was grooved to distribute oil to the threads. Oil probably travelled from the bevel gear box through the hollow jack shaft and out through small holes in the bottom of the groove. Tests on the individual components indicated that everything was satisfactory; but, when the complete control system mockup was tested, threads in the screw jacks were stripped. What steps were taken to correct this is not known to me.

Hydraulic Valves

8. Solenoid operated hydraulic valves were available to handle tubing sizes up to 8 or 10 mm in diameter and flow rates of 60 liters per minute. For higher flow rates, these valves were used to control other valves /as shown on Enclosure (G)/. I did not see inside these valves, but know they were the spool type and were ported as shown on the sketch. /[redacted] at [redacted] Testing, if any, is not known to me. 25X1 25X1 25X1

MISCELLANEOUS OBSERVATIONS

Helicopter Parts

9. The general shape of the tail boom /shown on Enclosure (H)/, particularly the fact that the fuselage end of the boom was not square, caused me to believe that the helicopter built at Zavod #1 was of the Sikorsky type, but I have no definite knowledge of the type or designation. The name of the designer is also unknown to me. The exact

production starting date is also unknown to me, but I know that parts were being built in 1950. As the EF-150 approached completion, the helicopter project took over more and more of the plant. I think that there was a good possibility for continued expansion as soon as more plant facilities became available. Germans had nothing to do with helicopter production and the usual tight security was maintained. I roughly estimate that 30 per month were produced by Soviet women under the direction of a Soviet supervisor (I do not know his name). I never saw any of the finished parts shipped and thus believe that they were stored somewhere in the plant area. The tail boom was of all riveted dural construction. I believe that the stringers were extruded bulb angles. I think that all aluminum parts were anodized but am not very sure. The finished booms were light yellow in color but were not painted. Further details are unknown.

10. I do not know the date that production of the landing struts was started, [redacted] a Soviet "test engineer" was supposed to run load-deflection curves on the cylinders. This engineer apparently did not know how to go about setting up the test and asked my help. My only information comes from questions asked in order to help set up the test. For example, he asked what fluids were put in the struts. The Soviet mechanics did not know what they had put in or in what proportions. It developed that a 50-50 mixture of alcohol and glycerin was supposed to be used. I have since forgotten the pressure used, but recall that each main strut was designed to support 2000 kilograms. Observing that it took a long time to fill the struts with fluid, I asked the reason and was told that there was a shock absorber built into the strut and this hindered the filling. 25X1

Radar Reflectors

11. As I recall, the reflectors /shown on Enclosure (I)/ were built for approximately one year ending in the summer of 1951. I once heard the production rate of 30 but do not remember what the time span was. The reflectors were built by approximately 30-40 German and Soviet workers in the Assembly Shop (Zeche 5) under [redacted] and his Soviet deputy, [redacted] The Germans at Podberesje had nothing to do with the design of the reflectors. [redacted] sketch shows the reflector made in four parts, it may have been further subdivided. The sections were hand-formed on rolls and checked against form blocks. Holes were put in the reflectors after forming. I do not remember the hole pattern nor do I know their purpose. There were no rods, grids, or other antennae parts in the reflectors. They were supported on tubular steel frames. The assemblies were hauled out of the plant on two-wheeled trucks which may or may not have been part of the units. I do not know the shipping destination of the reflectors. 25X1 25X1 25X1A

Possible Missile Parts

25X1X 12. [redacted] the Equipment Assembly Shop, [redacted] were making small elevator hinges. Due to the small size and high precision required, [redacted] they could be intended only for use on a missile. [redacted] Had the parts been made for the EF-150 or the 346, [redacted] would know about it. [redacted] no knowledge of the previously reported production of V-1 type missile parts. [redacted] 25X1X 25X1X 25X1X 25X1X

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Wind Tunnel

13. I have very little information on the tunnel at Podberezhe. It was built in 1948 and used a JUMO 004 engine for power. I am familiar with the steam jet tunnel in Dessau, but do not think the tunnel in Podberezhe operated on the same principle. I believe that the JUMO 004 engine was mounted downstream of the test section so that the intake air was drawn through the tunnel. The largest model I saw was about 40 cm in span.

ENCLOSURE (A) Mechanical Lock Used in Hydraulic Cylinders
ENCLOSURE (B) Schematic of Main Landing Gear - EF-150
ENCLOSURE (C) Main Landing Gear Shock Strut - EF-150
ENCLOSURE (D) Shock Strut Leakage Test Set-Up
ENCLOSURE (E) Outrigger Gear Shock Strut - EF-150
ENCLOSURE (F) Schematic of Flight Control System - EF-150
ENCLOSURE (G) Schematic of Hydraulic Valve - EF-150
ENCLOSURE (H) Sketch of Helicopter Parts
ENCLOSURE (I) Sketch of Radar Reflector

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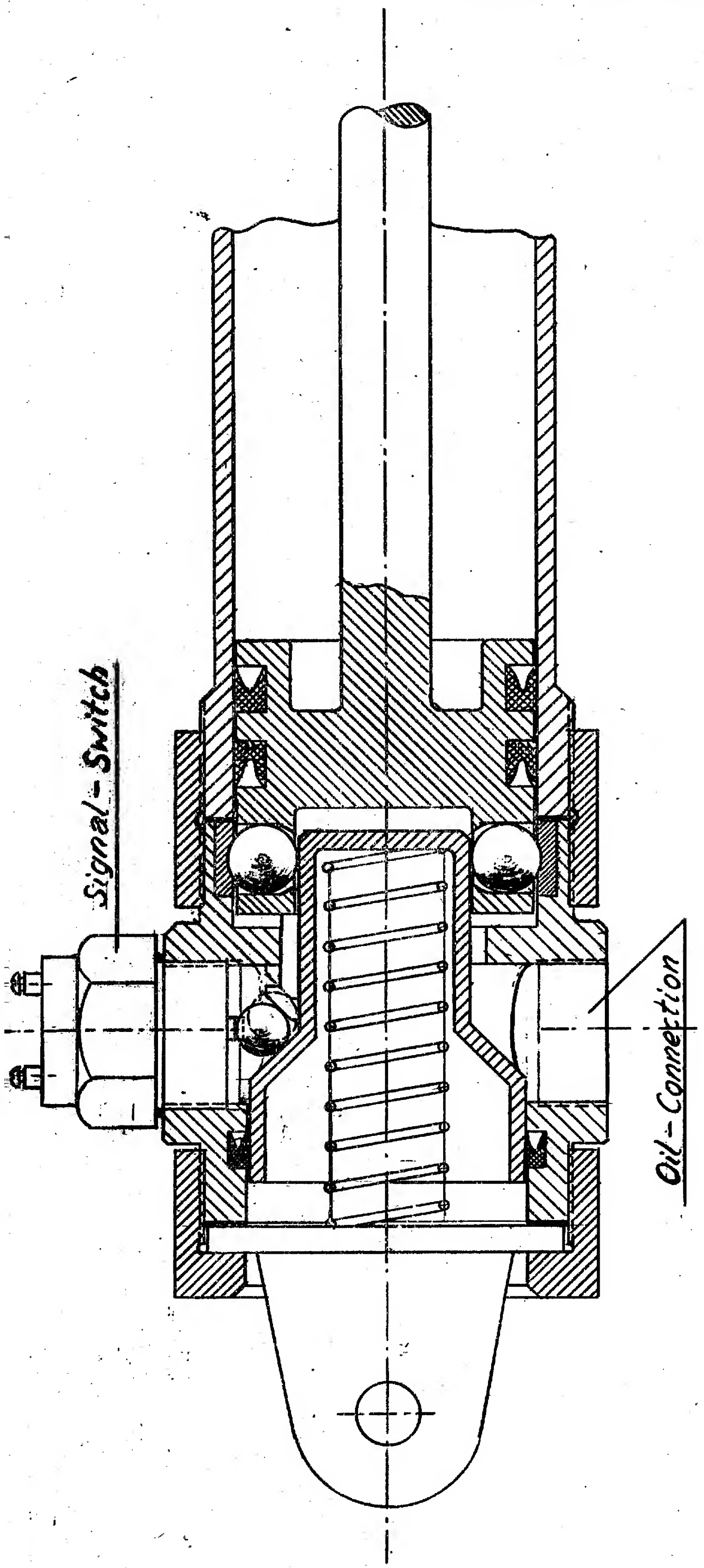
SECRET/SECURITY INFORMATION

Attachment A

25X1A



MECHANICAL LOCK USED IN HYDRAULIC CYLINDERS

ENCLOSURE (A)

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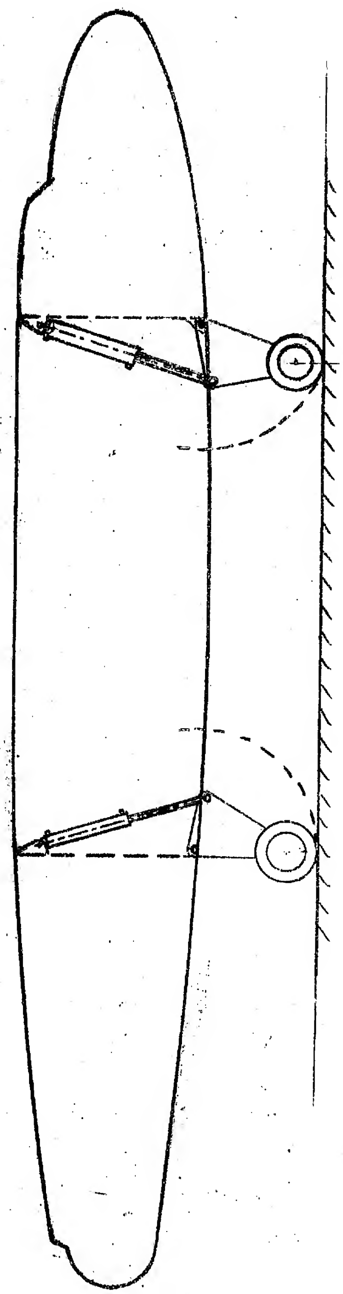
Attachment B

25X1A



SCHEMATIC OF MAIN LANDING GEAR - EF 150

ENCLOSURE (B)

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Attachment C

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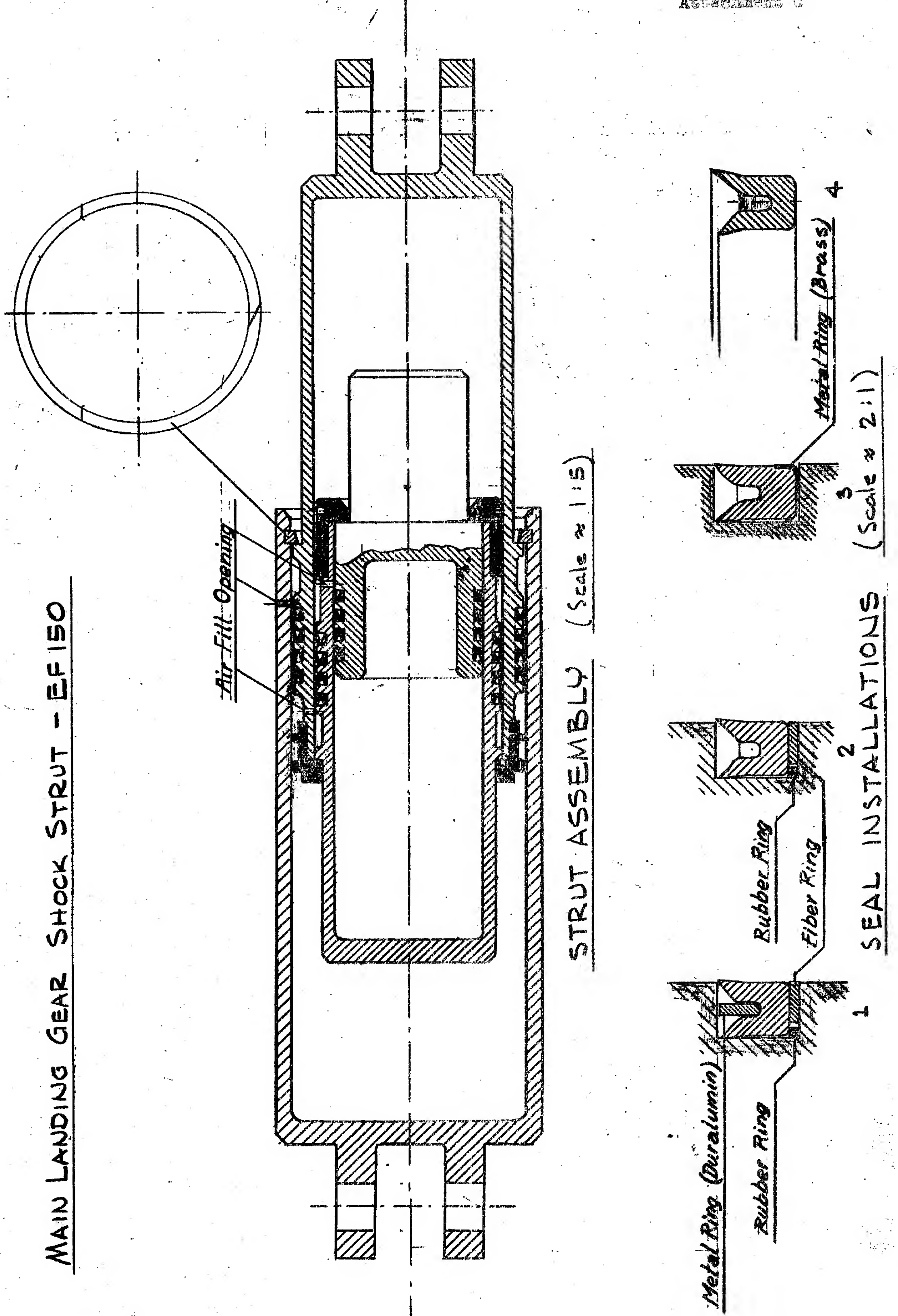

ENCLOSURE (C)

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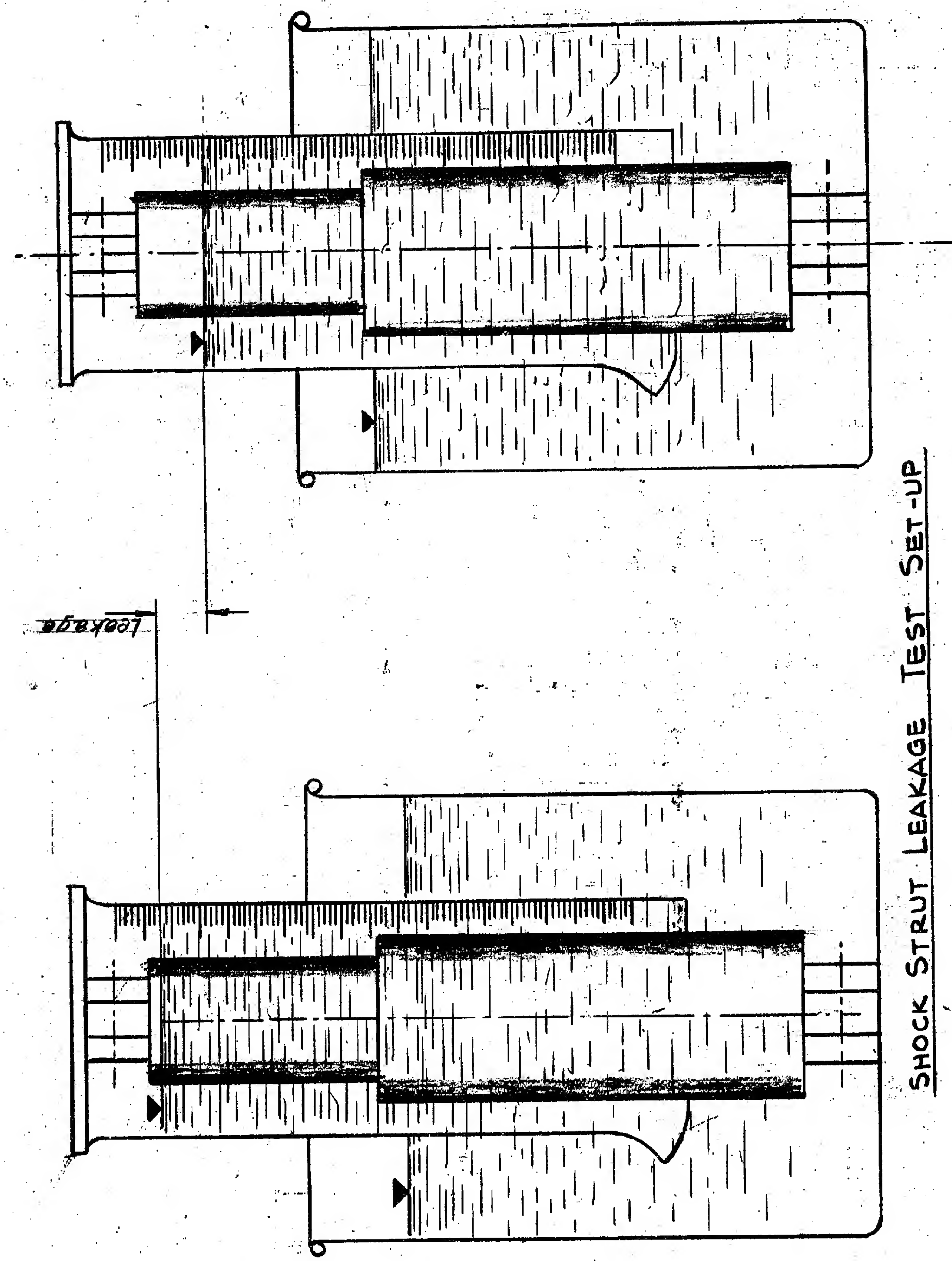
Attachment D



SHOCK STRUT LEAKAGE TEST SET-UP

ENCLOSURE (D)

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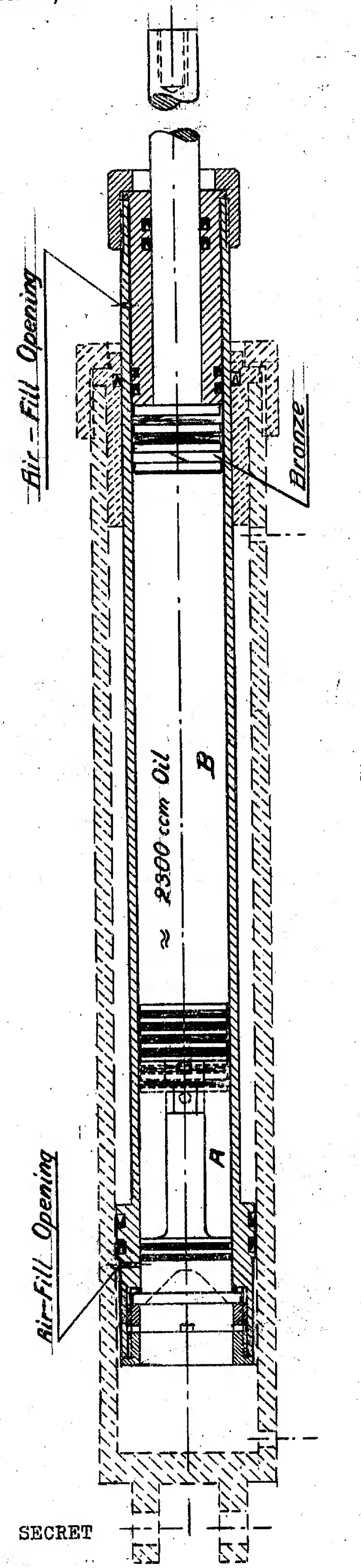
Attachment E



OUTRIGGER GEAR SHOCK STRUT - EF 150

Scale ≈ 1:5

ENCLOSURE (E)

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Attachment F

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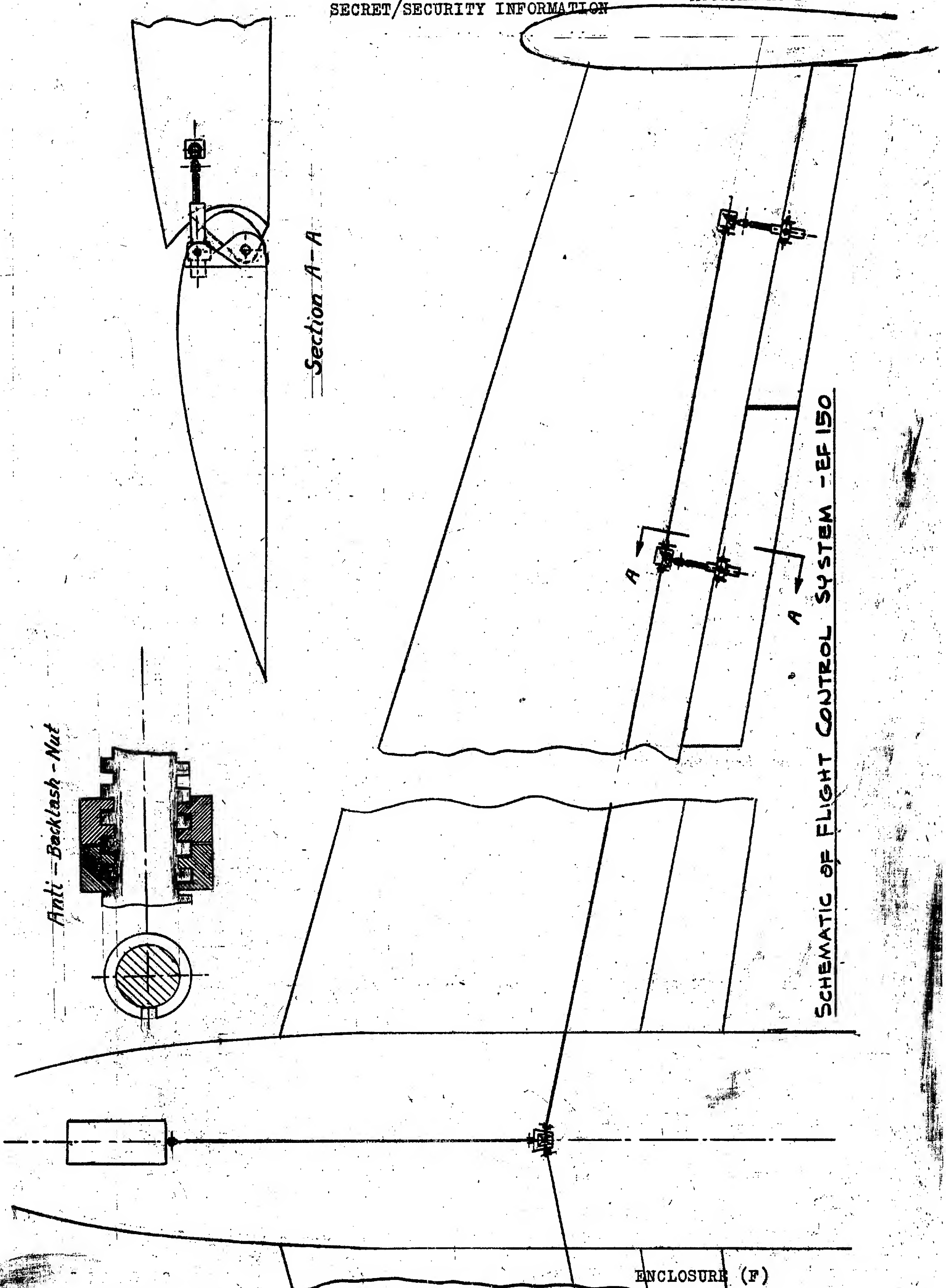

ENCLOSURE (F)

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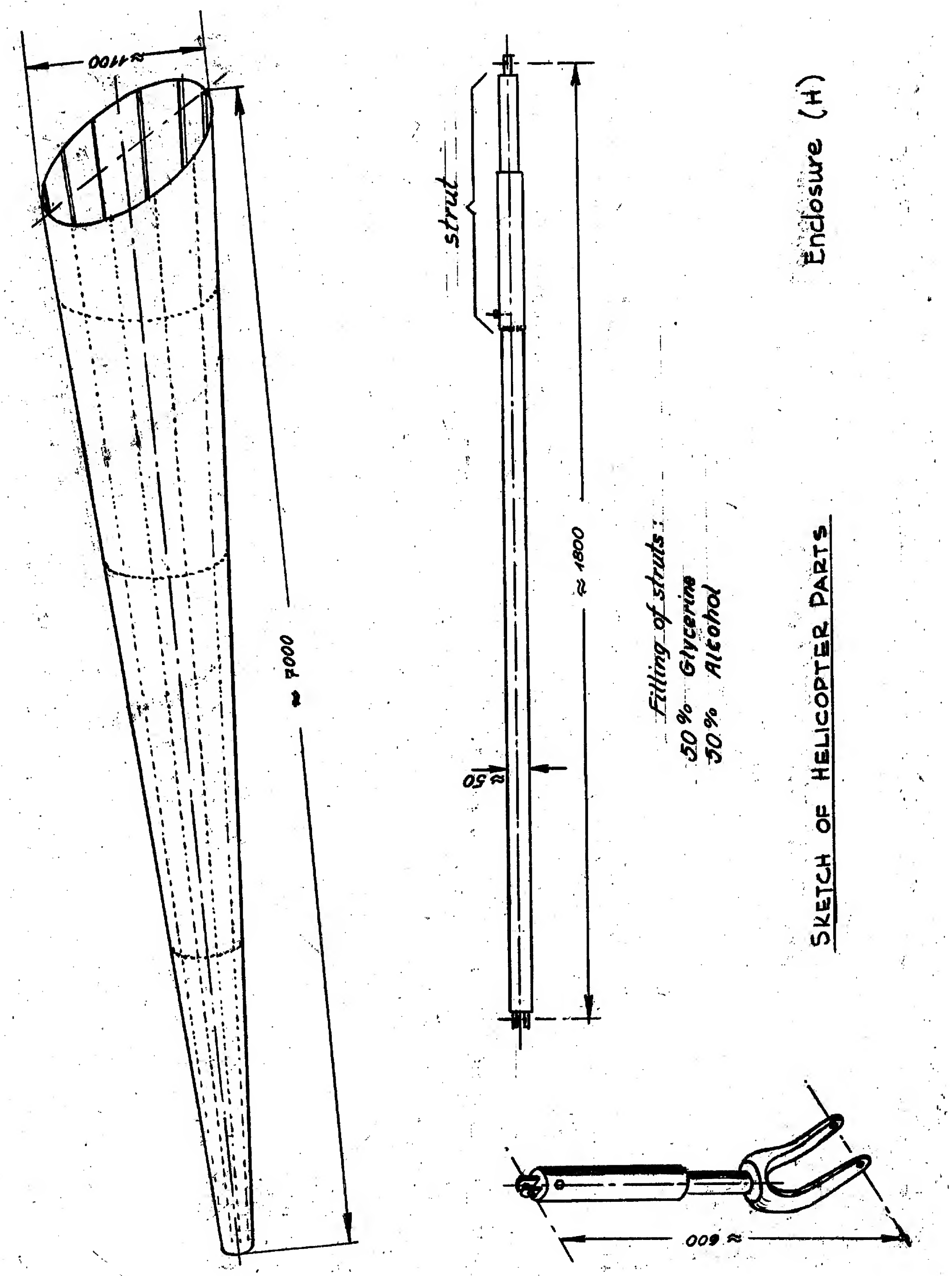
SECRET/SECURITY INFORMATION

Attachment H



ENCLOSURE (H)

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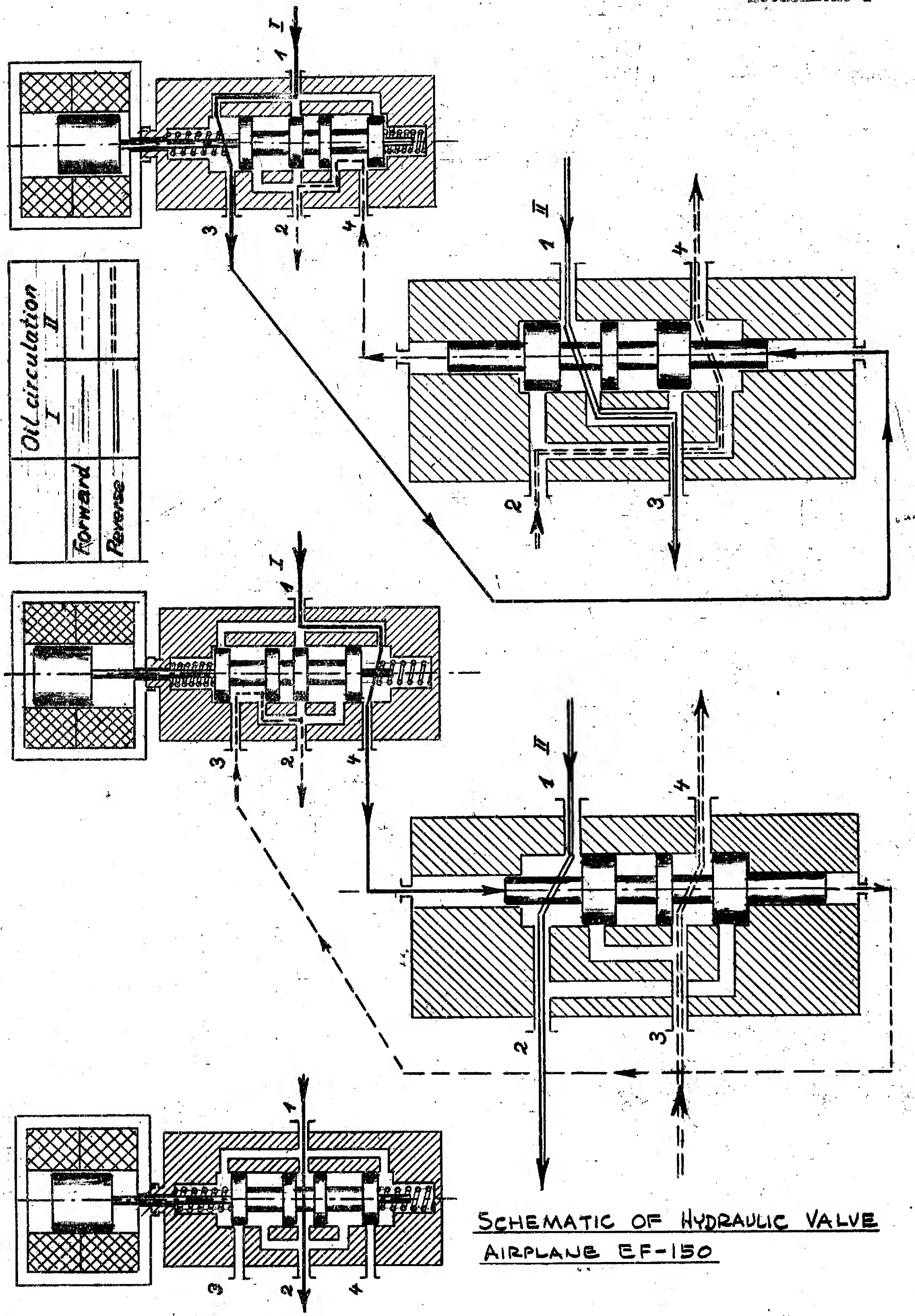
Attachment G



SCHEMATIC OF HYDRAULIC VALVE
AIRPLANE EF-150

ENCLOSURE (G)

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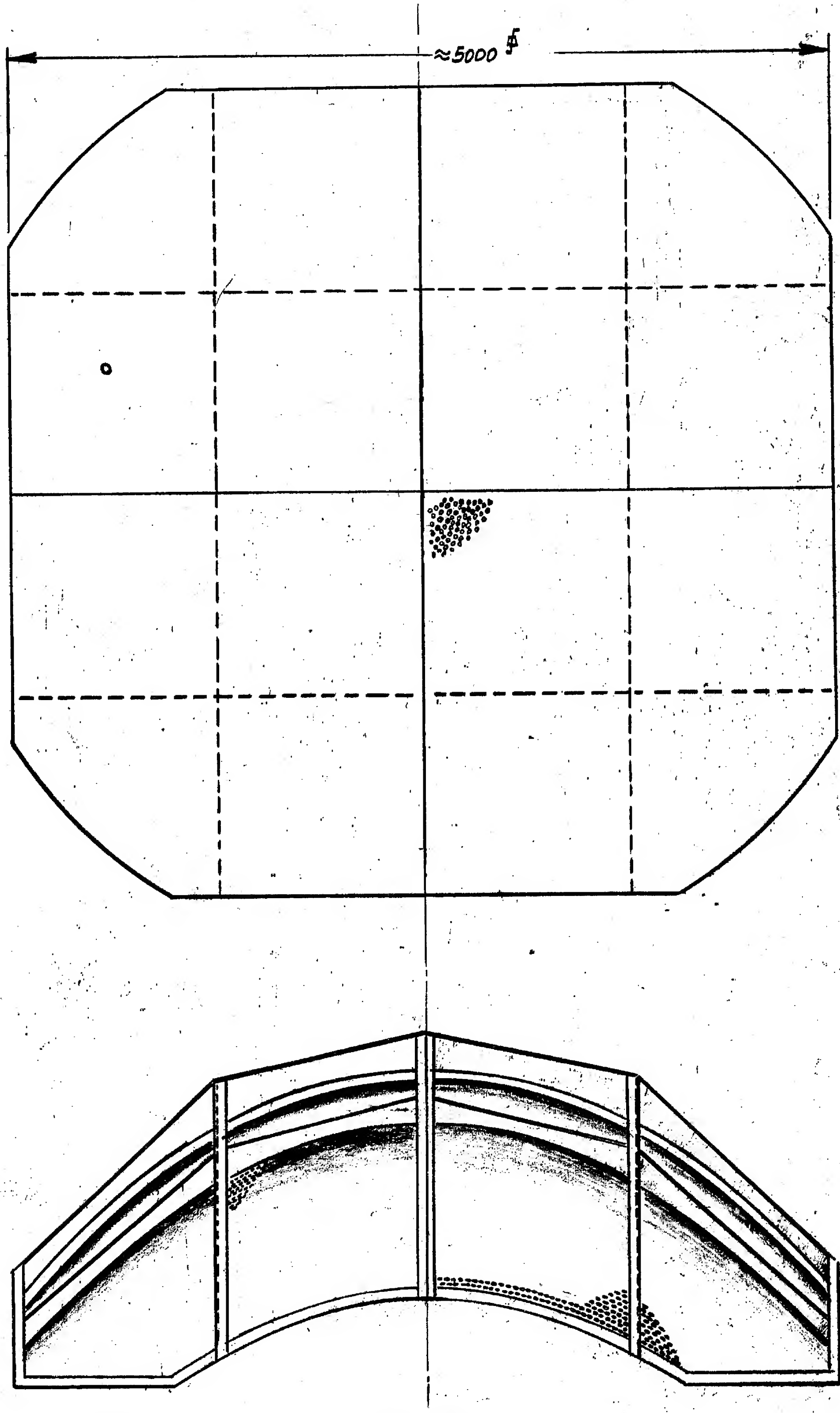
SECRET/SECURITY INFORMATION

Attachment I



SKETCH OF RADAR REFLECTOR

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ENCLOSURE (I)